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The value of Q substituted in the value of λ gives

$$6P^2-(5\lambda-\mu)P=\mu\lambda-\lambda^2-2, \text{ or } P=\frac{5\lambda-\mu\pm\sqrt{(\lambda^2+14\lambda\mu+\mu^2-48)}}{12}.$$

$$\text{Similarly, } Q=\frac{5\mu-\lambda\pm\sqrt{(\lambda^2+14\lambda\mu+\mu^2-48)}}{12}.$$

These values of P and Q substituted in (13) gives for the required locus

$$[(5p-q)\lambda+(5q-p)\mu+12r]^2=(p+q)^2)(\lambda^2+14\lambda\mu+\mu^2-48),$$
$$\text{or } (2p^2-pq)\lambda^2-2(p^2+q^2-pq)\lambda\mu+(2q^2-pq)\mu^2$$
$$+2r(5p-q)\lambda+2r(5q-p)\mu+12r^2+4(p+q)^2=0.$$

That is, $a\lambda^2+2\lambda\mu h+b\mu^2+2g\lambda+2f\mu+e=0$, which is the equation to the general conic.

DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

327. Proposed by V. M. SPUNAR, M. and E. E., East Pittsburg, Pa.

The coefficients of the algebraical equation $f(x)=0$ are all integers. Show that if $f(0)$ and $f(1)$ are both odd numbers, the equation can have no integral roots.

Solution by PROFESSOR F. L. GRIFFIN, Williams College.

Let the equation be $a_0x^n+a_1x^{n-1}+\ldots+a_{n-1}x+a_n=0$.

Then by hypothesis, a_n, and also $(a_0+a_1+a_2+\ldots+a_{n-1}+a_n)$ are odd numbers. By subtraction, $(a_0+a_1+\ldots+a_{n-1})$ is an even number; hence, either all these coefficients are even numbers, or there is an even number of odd coefficients.

Suppose (I) that $a_0, \ldots, a_{n-1}$ are all even. Then the substitution for x of *any* integer will give an even result for these terms, which cannot combine with the odd a_n to vanish.

Suppose (II) that an even number of coefficients $a_0, \ldots, a_{n-1}$ are odd integers. The substitution of any even integer for x cannot satisfy the equation, just as in (I). Any power of an odd integer (substituted for x) is odd, so that for each odd coefficient, one odd term is obtained. But there is an even number of these, besides a_n. Thus it is again impossible to have the equation satisfied by an integer.